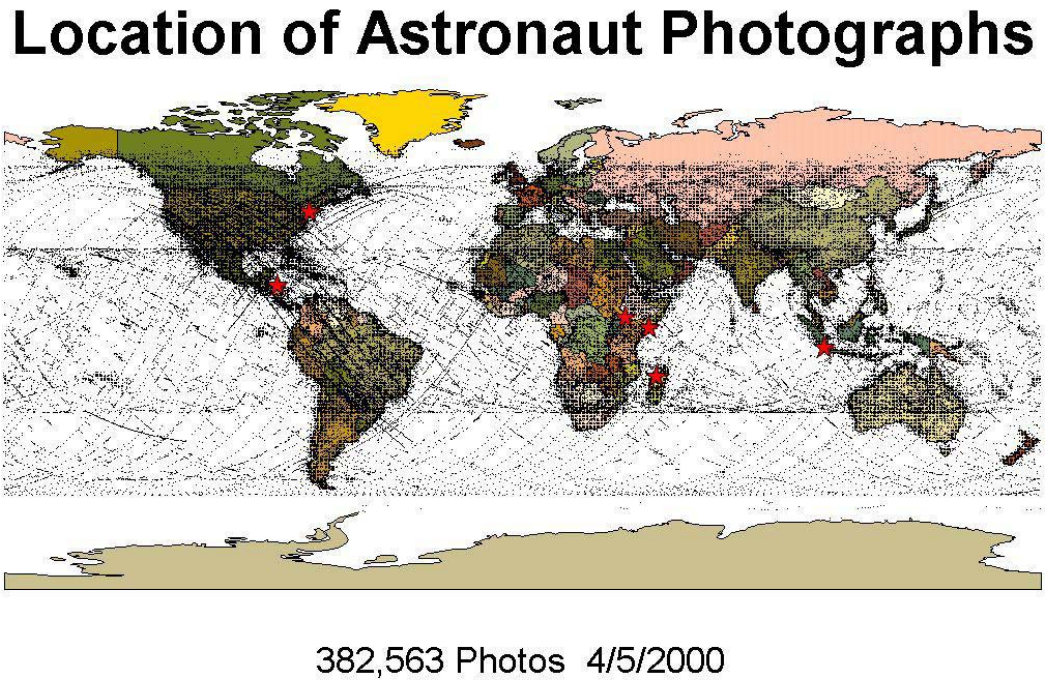
Space Shuttle/International Space Station Earth Observation Photography: Imaging for Human Health Applications

BACKGROUND

NASA Astronauts have used hand-held cameras to photograph the Earth for more than 30 years, beginning with the Mercury missions in the early 1960's. Since 1981, Space Shuttle astronauts have taken 400,000+ photographs of the Earth. The International Space Station (ISS) will continue the NASA tradition of Earth observation from human-tended spacecraft.

Astronauts are trained in scientific observation of ecological, geological, geographic, oceanographic, environmental and meteorological phenomena. They are also instructed in the use of photographic equipment and techniques. Preflight training helps the astronauts make informed decisions on which areas and phenomena to photograph. Specific areas of scientific interest are selected before each flight by a group of scientists. The astronauts receive intensive training, in-flight aids, and messages from the ground to help them locate these sites that are of scientific interest.



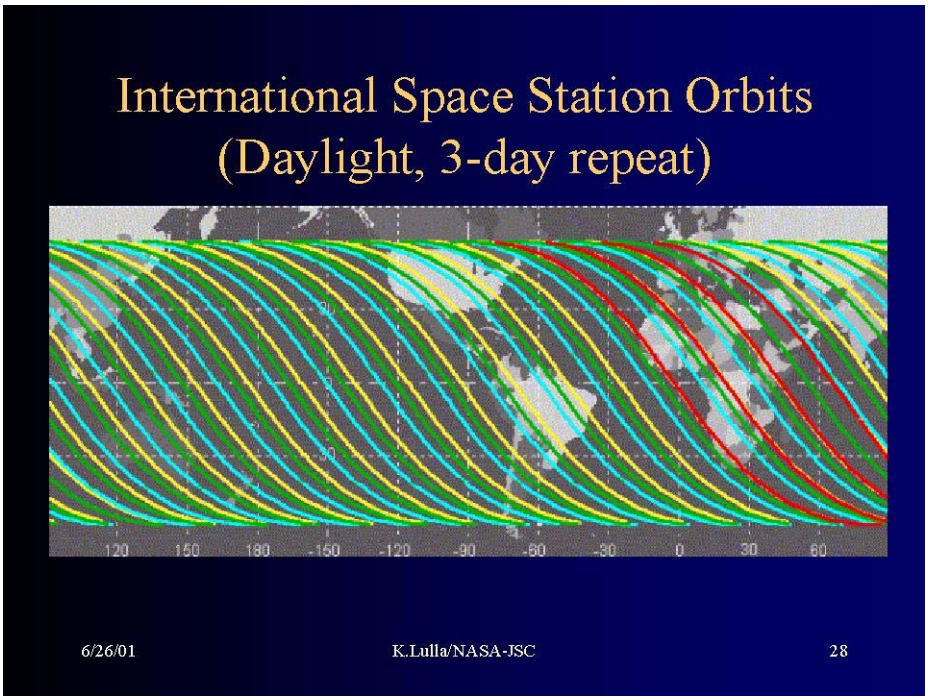
PHOTOGRAPHIC CHARACTERISTICS

Most of the photographs are in natural color. Color infrared film has also been used on some missions, and a small amount of black-and-white film has been used with polarizing filters. A number of lenses and film formats have been used producing a wide variety of both aerial coverage and spatial resolution.

The Shuttle flies at altitudes ranging from 213 to 617 kilometers (from 115 to 333 nautical miles), resulting in variation in coverage and resolution. The shuttle orbital track typically covers the tropical and temperate regions of the Earth between 28 degrees N and 28 degrees S latitude, but other missions have flown up to 57 degrees N and 57 degrees S latitude. Repeat coverage of an area is obtained by acquiring photographs on several missions and by taking photographs from different viewing angles during a single mission. As a result of the Earth's rotation and the duration of the orbits (approximately 90 minutes), an area may be photographed at different Sun angles during a single mission. Stereoscopic coverage is available for a number of areas.

The International Space Station (ISS) has an average altitude of 407 km (220 nautical miles) with an orbital inclination of 51.6°. The U.S. Laboratory Module on the ISS will have a window, with a clear aperture 50.8 cm in diameter, which will be perpendicular to the Earth's surface most of the time. The window's three panes of fused silica give it "optical quality." Instrumentation for Earth observation will include, but not be limited to, Hasselblad, Linhof, and Nikon hand-held cameras, plus sensors and imaging systems still to be developed.

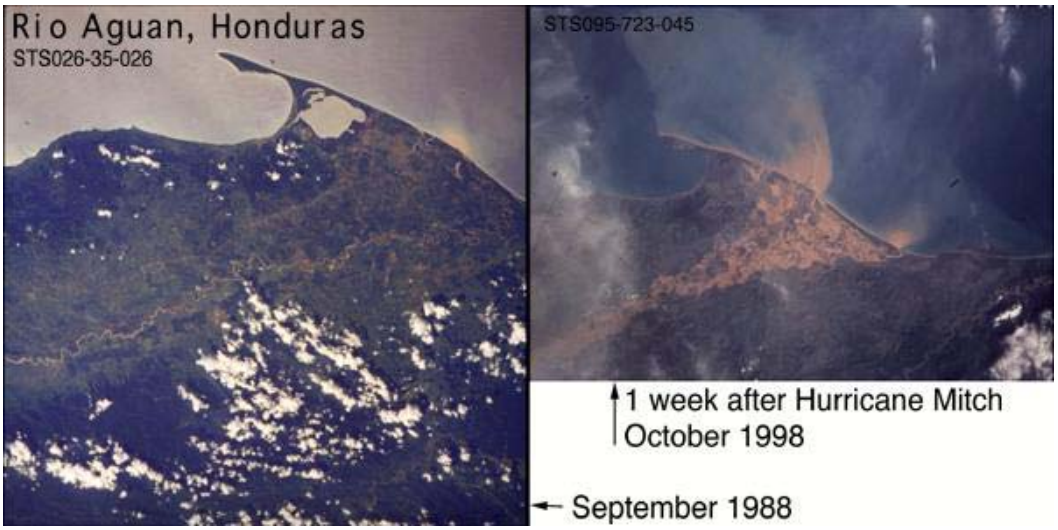
Artist's rendering of the International Space Station (ISS) after installation of the U.S. Laboratory Destiny and its nadir-viewing optical quality window during Space Shuttle Mission STS-98/Station Mission 5A in February 2001



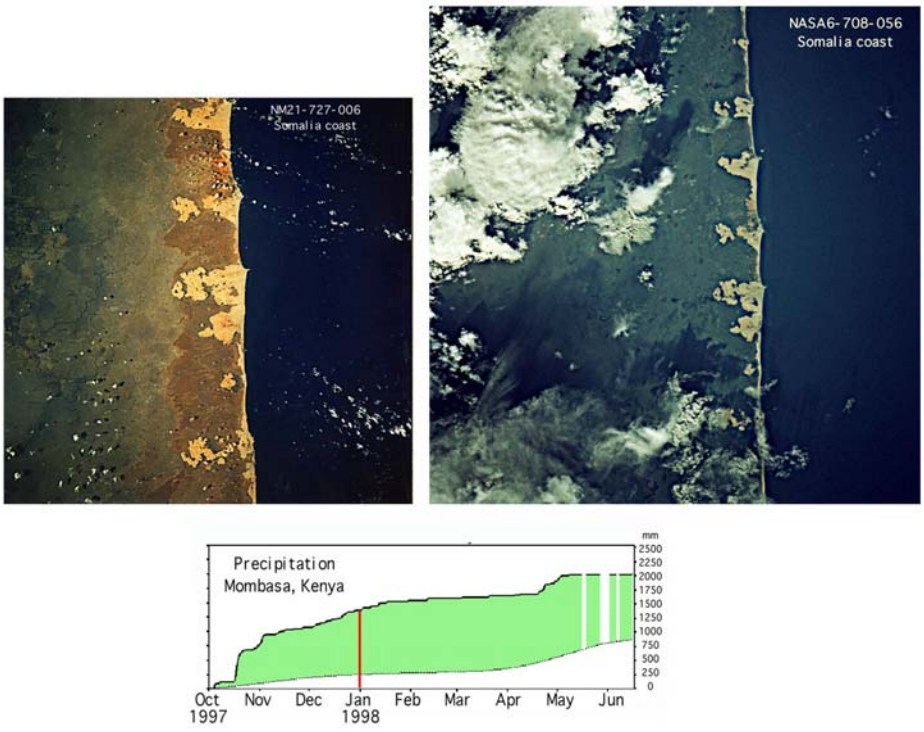
International Space Station and orbit passes as potential sources for human health applications.

USES FOR THE PHOTOGRAPHS

Orbital photography fills a niche between aerial photography and imagery from unmanned satellite scanners and complements these two familiar formats with additional information. The ability of the trained astronaut to rapidly identify and photograph interesting phenomena on the Earth makes the Shuttle photographs unique. Near-real-time information exchange with the crew facilitates the recording of current events of geological, oceanographic, environmental, and meteorological importance.



Example Honduras: Flooding in Honduras resulted in Cholera



Somalia example: El Niño-influenced heavy rains caused greening of east Africa and potential for spread of Rift Valley Fever.

Photographing at various Sun angles highlights different geologic features and takes advantage of sun glint to show intricate ocean structures and land/water interfaces. Critical environmental monitoring sites are photographed repeatedly over time; some have photographic records dating back to the Gemini and Skylab missions. Earth limb pictures taken at sunrise and sunset document changes in the Earth's atmospheric layering. Photographs of hurricanes, thunderstorms, squall lines, island cloud wakes, and the jet stream complement meteorological satellite images by offering better resolution and stereoscopic coverage of such phenomena.

Near-vertical or low-oblique angle photographs can be digitized at high resolution and used as three-band (RGB) remote sensing images in the same way a scientist would use data from Landsat, SPOT, or Terra satellites. These digital images can be classified to determine land use, land cover, or change over time.

The information above was obtained at http://eol.jsc.nasa.gov/ and from Dr. Kamlesh Lulla, Chief Scientist for Earth Sciences at NASA's Johnson Space Center.

For more information visit:

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